



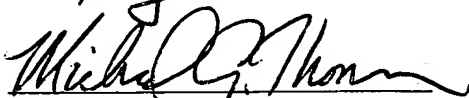
PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

St. Louis, Missouri
June 22, 1998

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited in the United States Postal Service as first class mail in an envelope addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231 on July 8, 1998.



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In re application of:
INDECK, RONALD S.

Serial No.: 08/822,778

Filed: March 21, 1997

For: THIN FILM MAGNETIC WRITE HEAD
WITH PRECONDITIONING GAP
(as amended)

Assistant Commissioner for Patents
Washington, D.C. 20231

Examiner Klimowicz, W.

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DECLARATION OF RONALD S. INDECK, Ph. D.

I, Ronald S. Indeck, Ph. D., under penalty of perjury, do hereby declare as follows:

1. That I am the same Ronald S. Indeck, Ph. D. who is named as the sole inventor in the above-identified application, and that I received a B.S., a M.S., and a Ph. D. in Electrical Engineering from the University of Minnesota. That enclosed herewith as Exhibit A is a curriculum vitae which details my professional career including my present position as a Professor of Electrical Engineering at Washington University in St. Louis, Missouri.
2. That I have reviewed U.S. Patent No. 4,908,724 to Jeffers, and I am familiar with magnetic recording heads of the type described therein.

3. That the Jeffers patent does not disclose, and does not relate, to thin film magnetic recording heads.

4. That, despite my extensive knowledge in the field of magnetic recording technology, I am unaware of any magnetic recording head of a type disclosed by the Jeffers patent, but having a thin film construction. More generally, I am not aware of any thin film magnetic recording head having multiple gaps.

5. That in my opinion as an expert in the field, even if one of ordinary skill in magnetic recording technology had been motivated, at the time the subject application was filed, to produce a magnetic head of a type disclosed by the Jeffers patent using a thin film construction, the resulting thin film head would not have many of the novel features of my invention.

6. That, as shown in Figure 1 of the subject application, which is sketched below as an elevation view (rather than a perspective view), a magnetic write head 20 according to the prior art includes a C-shaped magnetic core 22 having a coil 28 wrapped therearound.

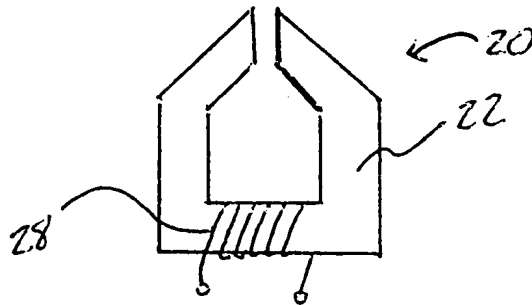


Figure 1 (modified).

7. That Figure 2 of the subject application illustrates how this write head 20 can be constructed using a thin film layering process to yield a thin film head having the following cross-sectional appearance:

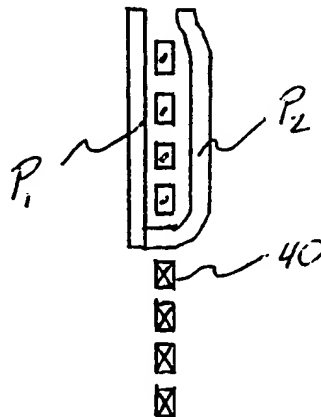


Figure 2(d) (inverted for comparison with Figure 1)

8. That, according to these prior art teachings, the cross-sectional shape of the magnetic core for a thin film head is very much like the shape of the magnetic core for a non-thin film head.

9. That, unlike the present invention, the magnetic coil 40 depicted in Figure 2(d) magnetically energizes only one gap, and the pole pieces P1 and P2 extend across only half of the windings of the magnetic coil 40.

10. That Figure 2 of the Jeffers patent discloses a non-thin film recording head 19 that includes a magnetic core 22 having two coils 32, 34 wrapped therearound. Sketched below is an elevation view (rather than a perspective view) of Figure 2 of Jeffers.

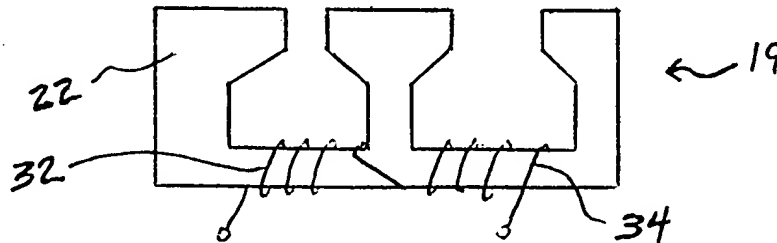
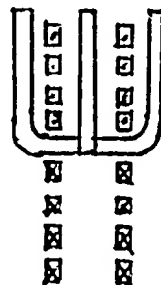


Fig. 2 of Jeffers (modified).

11. That, according to the teachings of the prior art, and as declared above, the cross sectional shape of the magnetic core for a thin film head is very much like the shape of the magnetic core for a non-thin film head. Thus, if one of ordinary skill had been motivated to produce the Jeffers head using a thin film construction, the resulting thin film head would have had the following cross sectional appearance:



Jeffers Head – Thin Film Construction

12. That, like the write head depicted in Figure 2 of Jeffers, the thin film equivalent depicted above has a similarly shaped magnetic core, as well as two coils wrapped therearound. Unlike my invention, however, a single magnetic coil is not used to magnetically energize two gaps, none of the pole pieces extend across substantially all of the windings of any single coil, and two of the pole pieces are joined to the same portion, rather than different portions, of a third pole piece.

13. That I have also reviewed the figures of the cited Russian patent, which disclose a magnetic core for a recording head that has essentially the same shape as the magnetic core shown in Figure 2 of Jeffers.

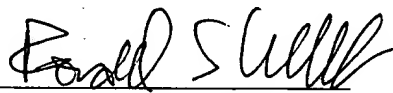
14. That, therefore, the magnetic core for the recording heads shown in the Russian patent would have had the same thin film equivalent as that depicted above for the Jeffers head.

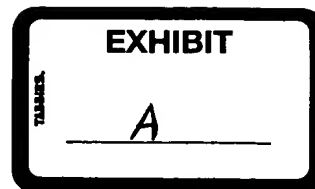
15. That, with the exception of my invention, I am unaware of any thin film magnetic recording head having a magnetic coil that can magnetically energize two gaps, or any thin film magnetic recording head having two pole pieces that are connected to different positions along the length of a third pole piece, or any thin film magnetic recording head having a pole piece that extends across substantially all of the windings of a pancake coil.

Further declarant sayeth not.

The undersigned being hereby warned that willful false statements and the like are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001, and that such willful false statements and the like may jeopardize the validity of the application or any patent issuing thereon, declares that all statements made of his own knowledge are true and that all statements made on information and belief are believed to be true.

July 2
Date


Ronald S. Indeck, Ph. D.



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EDUCATION

PhD University of Minnesota 1987
MSEE University of Minnesota 1984
BSEE University of Minnesota 1981

PROFESSIONAL EXPERIENCE

1988-present Professor, Director of MISC, Department of Electrical Engineering, Washington University, St. Louis, MO
1987-1988 NSF Fellow, Research Institute of Electrical Communication, Tohoku University, Sendai, Japan
1981-1982 Research Assistant, Honeywell Corporate Technology Center, Bloomington, MN
1979-1980 Consulting Engineer, Oftedahl, Locke, Broadston & Associates, Minneapolis, MN

AWARDS

National Science Foundation Presidential Young Investigator Award
Discover Award for Technological Innovation Finalist
IEEE Young Professional Award
IBM Faculty Development Award
National Science Foundation International Exchange Award
Eastman Kodak Fellowship
IEEE Centennial Young Engineer "Key to the Future" Award
American Electronics Association/HP Faculty Development Fellowship
Bausch and Lomb Honorary Science Award

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PATENTS and APPLICATIONS

"Method and apparatus for fingerprinting magnetic media", US Patent 5,365,586.
"Method and apparatus for process control, tension control and testing of magnetic media", US Patent 5,408,505.
"Method and apparatus for noise reduction in magnetic recording media".
"Method and apparatus for fingerprinting and authenticating magnetic media", US Patent 5,428,683.
"Method and apparatus for noise reduction in magnetic media recordings", US Patent 5,587,654.
"Method and apparatus for noise reduction in magnetic media", Australian Patent 680498.
"Magnetic recording head with continuously monitored track following servo".
"Method and apparatus for fingerprinting and authenticating various magnetic media", US Patent 5,546,462; 5,740,244, Australian Patent 688956.
"Method and apparatus for a Vernier magnetic recording head".
"Method and apparatus for multiplicative noise precompensation for magnetic recordings".
"Method and apparatus for secure data storage and manipulation using magnetic media", US Patent 5,625,689.
"Method and apparatus for fingerprinting and authenticating various magnetic media", European Patent 95929523.9-2210, Australian Patent 680901.

PROFESSIONAL SOCIETY ACTIVITIES

Senior Member of the IEEE; Member of the IEEE Magnetics Society Administrative Committee; General Chairman, Program Chairman, Local Chairman, Intermag Conference; Editor IEEE Transactions on Magnetics; Chairman St. Louis Combined Group; Vice-chairman and Secretary of the IEEE Magnetics Group

Member of the American Physical Society

Member of Congressional Advisory Group on Science, Technology and Telecommunications

Member American Association for the Advancement of Science, Eta Kappa Nu

PUBLICATIONS

- R. S. Indeck and J. H. Judy, "Measurements of surface magnetic fields of perpendicular and longitudinal magnetic recorded transitions using a magnetoresistive transducer", *IEEE Trans. on Magn.*, vol. 20, 730 (1984).
- R. S. Indeck, M. J. Vos, E. Persson, N. Curland and J. H. Judy, "Direct measurements of external magnetic fields from a single pole type recording head using a microloop", *IEEE Trans. on Magn.*, vol. 23, 2085 (1987).
- S. Y. Lee, R. S. Indeck, Y. Yip and J. H. Judy, "Comparison of the magnetic recording performance of medium-scale ring, pole, and metal-in-gap heads", *IEEE Trans. on Magn.*, vol. 23, 2491 (1987).
- R. S. Indeck, S. Iwasaki and J. H. Judy, "A magnetoresistive gradiometer", *IEEE Trans. on Magn.*, vol. 24, 2617 (1988).
- R. S. Indeck, "An analysis of multilayered thin-film magnetic field gradiometers having a superconducting spacer", *J. Magn. Soc. Japn.*, vol. 13-S1, 599 (1989).
- M. W. Muller, R. S. Indeck, E. S. Murdock and R. Ornes, "Track edge fluctuations", *J. Appl. Phys.*, vol. 67, 4683 (1990).
- G. Mian and R. S. Indeck, "Interaction factors in an energy analysis of a multi-layered magnetic film system", *IEEE Trans. on Magn.*, vol. 26, 2415 (1990).
- R. S. Indeck, S. C. Reising, J. R. Hoinville and M. W. Muller, "dc track edge interactions", *J. Appl. Phys.*, vol. 69, 8, 4721 (1991).
- G. Mian and R. S. Indeck, "An interaction matrix for the energy analysis of an n-layered magnetic thin film system", *J. Magn. Magn. Mats.*, vol. 96, 248 (1991).
- R. S. Indeck, Guo Mian and M. W. Muller, "Determination of a track's edge by differential power spectrum", *Japn. J. Appl. Phys.*, vol. 31, 8A, part 2 (1992).
- Guo Mian, R. S. Indeck and M. W. Muller, "Micromagnetic transverse correlation length in thin film magnetic recording media, and head positioning applications", *J. Magn. Magn. Mats.*, vol. 152, 253 (1996).
- J. R. Hoinville, R. S. Indeck and M. W. Muller, "Spatial noise phenomena of longitudinal magnetic recording media", *IEEE Trans. on Magn.*, vol. 28 (1992).
- Guo Mian, R. S. Indeck and M. W. Muller, "Noise correlation of a magnetic thin film medium", *Japn. J. Appl. Phys.*, vol. 30, 8B, part 2 (1991).
- R. S. Indeck, M. N. Johnson, Guo Mian, J. R. Hoinville and M. W. Muller, "Noise characterization of perpendicular media", *J. Magn. Soc. Japn.*, vol. 15-S2, 153 (1991).
- Guo Mian, R. S. Indeck and M. W. Muller, "Transverse correlation length in thin film media", *IEEE Trans. on Magn.*, vol. 28, 2733 (1992).
- Guo Mian, R. S. Indeck and M. W. Muller, "An *in-situ* measurement of intergranular coupling in magnetic film media", *J. Appl. Phys.*, vol. 73, 4, 2027 (1992).
- J. A. O'Sullivan, D. G. Porter, R. S. Indeck and M. W. Muller, "A physically based approach to information theory for thin film magnetic recording", *Proc. Allerton Conf. on Comm.*, 792 (1992).

- J. A. O'Sullivan, D. G. Porter, R. S. Indeck and M. W. Muller, "Physically based information science of magnetic recording: I. Information capacity of a medium model", *IEEE Trans. on Magn.*, vol. 29, 6, 4036 (1993).
- R. S. Indeck and E. Glavinas, "Fingerprinting of magnetic media", *IEEE Trans. on Magn.*, vol. 29, 6, 4095 (1993).
- M. W. Muller and R. S. Indeck, "Intergranular exchange coupling", *J. Appl. Phys.*, vol. 75, 4, 2289 (1993).
- J. A. O'Sullivan, D. G. Porter, R. S. Indeck and M. W. Muller, "Recording medium properties and capacity bounds", *J. Appl. Phys.* vol. 75, 10, 5753 (1993).
- H. S. Chen, R. S. Indeck and M. W. Muller, "Lead structures for thin film magnetic recording heads", *IEEE Trans. on Magn.*, vol. 30, 5, 2818 (1994).
- D. G. Porter, J. A. O'Sullivan, R. S. Indeck and M. W. Muller, "Physically based information science of magnetic recording: II. Physical sources of medium noise", *IEEE Trans. on Magn.*, vol. 30, 6, 4266 (1994).
- E. Glavinas, R. S. Indeck, P. Dhagat and M. W. Muller, "Data distortion due to magnetic medium microstructure", *IEEE Trans. on Magn.*, vol. 33, 2, 1069 (1997).
- H. S. Chen, R. S. Indeck and M. W. Muller, "Analysis of lead structures for thin film magnetic recording heads", *Japn. J. Appl. Phys.*, vol. 18, S1, 209 (1994).
- J. A. O'Sullivan, D. Agrawal, D. G. Porter, R. S. Indeck and M. W. Muller, "Magnetic recording system design to reduce medium noise through signal precompensation", *Proc. 28th CISS*, 1152 (1994).
- R. S. Indeck and J. A. Bain, "A Vernier head structure", submitted to *IEEE Trans. on Magn.*
- J. A. O'Sullivan, D. Agrawal, R. S. Indeck and M. W. Muller, "Write-read-write signal precompensation techniques for magnetic recording", *SPIE*, vol. 2605 (1995).
- J. A. O'Sullivan, D. Agrawal, R. S. Indeck and M. W. Muller, "Signal precompensation for multiplicative noise in magnetic recording", *Proc. 29th CISS* (1995).
- J. A. Bain, W. Jayasekera, M. H. Kryder, A. Jander and R. S. Indeck, "Design of small recording head elements using thermally constrained transmission line modeling", *IEEE Trans. on Magn.*, vol. 31, 6, 2675 (1995).
- P. Dhagat, E. Glavinas, A. Jander, D. G. Porter, R. S. Indeck and M. W. Muller, "Trackwidth dependence of transition jitter", *J. Appl. Phys.*, vol. 79, 8, 4695 (1996).
- D. G. Porter, E. Glavinas, P. Dhagat, J. A. O'Sullivan, R. S. Indeck and M. W. Muller, "Irregular grain structure in micromagnetic simulation", *J. Appl. Phys.*, vol. 79, 8, 5652 (1996).
- A. Jander, R. S. Indeck, J. A. Brug and J. H. Nickel, "A model for predicting heating of magnetoresistive heads", *IEEE Trans. on Magn.*, vol. 32, 5, 3392 (1996).
- E. Glavinas, R. S. Indeck and M. W. Muller, "dc track edge interactions at close spacing", *IEEE Trans. on Magn.* vol. 33, 5, 2686 (1997).
- E. Glavinas, C. S. Baw, R. S. Indeck, H. C. Tong and M. W. Muller, "Transition shifts due to applied head fields", *IEEE Trans. on Magn.* vol. 33, 5, 2683 (1997).
- A. Jander, P. Dhagat, R. S. Indeck and M. W. Muller, "MFM observation of localized demagnetization in magnetic recordings", *IEEE Trans. on Magn.*, in press (1998).
- R. S. Indeck, P. Dhagat, A. Jander and M. W. Muller, "Effect of trackwidth and linear spacing on stability and noise in longitudinal and perpendicular recording", *J. Mag. Soc. Japn.*, vol. 21, S2, 205 (1997).
- E. Glavinas, R. S. Indeck and M. W. Muller, "Study of non-linear dipulse interactions", submitted to *J. Appl. Phys* (1998).
- P. Dhagat, R. S. Indeck and M. W. Muller, "Spin-stand measurements of time and temperature dependence of magnetic recording", submitted to *J. Appl. Phys* (1998).

Ronald S. Indeck was born in Minneapolis, Minnesota. He received the BSEE, MSEE, and PhD degrees from the University of Minnesota in 1981, 1984, and 1987. He was a National Science Foundation Research Fellow in 1987-88 at Tohoku University in Sendai, Japan. Since 1988 he has been in the Department of Electrical Engineering at Washington University where he is currently Professor and Director of the Magnetism and Information Science Center. President Bush presented him with a National Science Foundation Young Investigator Award and he has received the IBM Faculty Development Award, the IEEE Centennial Key to the Future Award and the IEEE Young Professional Award among other awards. He is a senior member of the IEEE, member of the American Physical Society, and many other professional organizations. He has served on many local committees and group activities, chaired sessions and served several international conferences including General Chairman for Intermag, is an editor for the IEEE Transactions on Magnetism, and is a member of the IEEE Magnetism Society Administrative Committee.